REMARKS

Claim 2 has been canceled without prejudice. Claim 1 has been amended to incorporate the subject matter of claim 2 and to obviate minor informalities; therefore, claim 1 now has the same scope as claim 2. Claims 3 and 6 have been amended to address minor informalities, and the present amendments to these claims have no limiting effect on claim scope.

New claim 7 has been added to recite subject matter supported on page 7, lines 4-14, of the instant specification, wherein the "work speed values" correspond to operation of the combine to harvest a field and the "road speed value" corresponds to operation of the combine to travel along a road.

The present amendment adds no new matter to the instant application.

The Invention

The present invention pertains broadly to combine harvesters having a fully electronic engine for optimizing fuel consumption depending upon the operating state of the combine. More specifically, the present invention is directed to a combine harvester, including a threshing, cleaning and separation system, and comprising: (a) wheels for propelling the combine harvester over the ground; (b) an engine driving said wheels via a hydrostatic drive system of a transmission, wherein the transmission includes a gear select lever for changing a gear ratio of the transmission; (c) a manually operable throttle control switch having a plurality of positions, each position corresponding to a desired engine speed level; (d) a speed modification switch having a first state and a second state, wherein movement of the gear select lever from a first position to a second position switches the

speed modification switch from the first state to the second state and changes the gear ratio; and (e) an engine control circuit for controlling the speed of said engine, wherein the engine control circuit comprises a programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch; the engine control circuit being responsive to input from said throttle control switch and said speed modification switch for selectively controlling said engine to run at a first speed for a given position of said throttle control switch when said speed modification switch is in said first state and to run at a second speed higher than said first speed when said throttle control switch is in said given position and said speed modification switch is in said second state.

Various other embodiments in accordance with the present invention are described in the dependent claims. The main advantage of the embodiments in accordance with the present invention is that a combine harvester is provided having an engine speed control system that avoids power overload of harvester components (i.e., a threshing, cleaning and separation system for processing a cut crop material) and that yields optimal fuel efficiency when harvesting a crop and when operating at higher engine speeds for propelling the harvester on a roadway.

The Rejections

Claims 1-6 stand rejected under 35 U.S.C. 103(a) as unpatentable over Diekhans (U.S. Patent 6,073,428) in view of Ushiro et al. (U.S. Patent 4,953,427).

Applicant respectfully traverses the rejection and requests reconsideration of the application for the following reasons.

Applicant's Arguments

The Diekhans reference teaches a "device for regulating drive engine power output" that operates to protect a single implement against overload by reducing engine power and "also to regulate the drive engine in such a way that maximum power is available for the working functions of the self-propelled working machine without any of the implements overloaded in their function" (col. 2, lines 24-30, emphasis added). The specification of the present application identified this subject matter as previously known, and pointed out that the disadvantage of these systems, such as taught by Diekhans, is an undesirable limit on obtainable maximum ground speed and corresponding fuel inefficiency when traveling on a roadway (See instant specification, page 1, line 18, to page 2, line 2).

In other words, Diekhans describes a device for regulating drive engine power output that has the disadvantages ascribed to the prior art systems as discussed by the present specification. In terms of structure, Diekhans describes a combine harvester (C) as schematically shown in Figures 1 and 3, which illustrate a drive engine (1) with power regulator (1A), main drive (2) and power take-offs (3), (4) and (5). Engine power output (PA) is distributed to transmission (PG) and to power train outputs (PN1), (PN2) and (PN3). Measuring devices (2A), (3A), (4A) and (5A) measure power-limiting torque variables and provide input signals to evaluating and control device (6), which may be a microprocessor (col. 5, lines 45-53). The control device (6) processes this measured torque information into a control signal (S) by using a suitable evaluating software program to compare the measured torque values with stored limit values (col. 5, lines 53-57). The

control device (6) compares the measured values with the limit values to yield a differential value, and uses the differential value to determine a new control signal (S), (col. 5, line 57, to col. 6, line 3).

The control signal (S) is used to regulate the engine (1) by reducing the drive power of the engine so at to avoid overloading of the implements (3), (4), (5) or the main drive (2), or to mobilize power reserves of the engine (i.e., increase engine drive power) when the sensors detect incomplete loading of the main drive (2) or one of the power take-offs (3), (4), (5), (col. 6, lines 10-16). In other words, the control device (6) taught by Diekhans only operates to reduce engine power to prevent overload of the implements or the main drive, but not to save fuel when the combine harvester is traveling over roads. On the contrary, control device (6) operates to increase engine power when there is incomplete loading of the power-take offs, such as would occur during travel on roads, which would result in inefficient fuel consumption.

As admitted by the Examiner, the Diekhans reference fails to teach, or even suggest, the following features recited in claim 1: (a) an gear select lever of a transmission, (b) a manually operable throttle control switch, and (c) a speed modification switch (Office Action, dated September 8, 2003, page 2, lines 16-17). Although not explicitly stated by the Examiner, it follows that Diekhans also does not teach, or even suggest, the structural relationship wherein the "engine control circuit" is connected to receive input from the throttle control switch and the speed modification switch, and that the engine control circuit is responsive to the input from the throttle control switch and the speed modification switch "to run at a first speed for a given position of said throttle control when said speed modification switch is in said first state and to run at a second speed

higher than said first speed when said throttle control is in said given position and said speed modification switch is in said second state" as recited in claim 1.

The Ushiro et al. reference discloses a "vehicle speed control system" that is applied to a "tractor" as shown in Figure 1, wherein the vehicle speed control system, as shown in Figure 3 or 4, has (a) a foot pedal (24) mechanically connected to a hydrostatic transmission (11), which is mechanically connected to a speed governor (17) that controls the rotational rate of the engine (1), (b) a hand accelerator lever (21) mechanically connected to the speed governor (17), and (c) an auxiliary change speed lever (25) that has an output shaft (13) operatively connected through differential (14) to the rear wheels (6) as shown in Figure 2, (col. 3, lines 2-62). It is noted that the auxiliary change speed lever (25) is connected to the differential (14) to the rear wheels (6) and not to the engine (1).

The Ushiro et al. reference does not teach an "engine control circuit" in accordance with the present invention. Specifically, the present invention, as recited in claim 1, is a "combine harvester" that includes (a) wheels, (b) an engine connected to a transmission that includes a gear select lever, (c) a throttle control switch, (d) a speed modification switch, and (e) an engine control circuit connected to receive input from the throttle control switch and the speed modification switch, wherein the engine control circuit comprises a programmable microprocessor responsive to the input so as to control the engine speed.

The "engine control circuit" in accordance with the present invention is a separate element, in particular, a programmable microprocessor. The programmable microprocessor recited in claim 1 is connected "to receive input from the throttle control switch and the speed modification switch." However, the Ushiro et al. reference teaches

~~no such programmable microprocessor.~~ The Examiner argues generally that "Fig. 3" of the Ushiro et al. reference is an "engine control circuit" formed by "the totality of the control surfaces and interlocks" (Office Action, dated September 8, 2003, page 2, lines 24-25). Furthermore, the Examiner clearly states that the Ushiro reference does not disclose a programmable microprocessor (Office Action, dated April 24, 2003, page 3, line 13-14).

Specifically, however, what the Ushiro et al. reference does teach is that the foot pedal (24), the auxiliary change speed lever (25), and the hand accelerator lever (21) are components of an "engine control circuit." Thus, the "engine control circuit" taught by Ushiro is distinguished from that of the present invention because claim 1 requires that the throttle control switch, the speed modification switch, and the engine control circuit are all separate elements. Furthermore, claim 1 requires that the "engine control circuit" is a programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch, and to be responsive to various states of these switches, wherein the state of the speed modification switch is determined by the position of the gear select lever in a specifically claimed manner.

In addition, the Ushiro et al. reference teaches an auxiliary change speed lever (25) that is not equivalent to the "gear select lever" of the present invention. The present invention, according to claim 1, requires that "movement of the gear select lever from a first position to a second position switches the speed modification switch from the first state to the second state and changes the gear ratio" so that the engine runs "at a first speed for a given position of said throttle control when said speed modification switch is in said first state and to run at a second speed higher than said first speed when said throttle

control is in said given position and said speed modification switch is in said second state." This claimed structural and functional relationship is not taught by the Ushiro et al. reference.

Ushiro's auxiliary change speed lever (25) is operable to control the auxiliary change speed device (12) that is connected through a differential (14) to rear wheels (16). Furthermore, lever (25) is connected to an interlocking device so that when lever (25) is in a high speed position (H), inner wire (28a) is in an interlocking state with release wire (28), whereas when lever (25) is in positions (M) or (L), then inner wire (28a) and release wire (28) are in the non-interlocking state (col. 3, lines 3-12, lines 30-68, and col. 4, lines 1-3). The locking and non-locking states influence the effect of foot pedal (24) as evident from Figure 3; however, depressing the foot pedal (24) forward to (F) is still required to increase the rotational rate of the engine (1) when lever (25) is in position (H) and inner wire (28a) and (28) are in the locking state (col. 4, lines 4-14). In other words, if moving lever (25) from position (H) to either position (M) or (L) is construed to switch foot pedal (24), inner wire (28a) and release wire (28) between the locking state (i.e., first state) and the non-locking state (i.e., second state), one skilled in the art would realize that there is no controlled change of the engine's speed when switching between the locking state and the non-locking state while the hand accelerator (21) is in a given set position.

This is different from the present invention which requires that the engine "run at a **first speed for a given position** of said throttle control when said speed modification switch is in said **first state** and to run at a **second speed** higher than said first speed when said throttle control is **in said given position and said speed modification switch is in said second state**." In other words, lever (25) taught by Ushiro is not equivalent to the

"gear shift lever" in accordance with the present invention because lever (25) cannot affect engine speed by shifting between non-locking and locking states. This shifting, as taught by Ushiro, merely affects how foot pedal (24) operates and does not directly switch the foot pedal to the forward (F) position to effect a higher rate of engine speed.

To summarize, the Ushiro et al. reference fails to teach the following the subject matter of claim 1: (a) it does not teach a separate "engine control circuit," (b) it does not teach a programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch, and (c) the "auxiliary change speed lever" (25) taught by Ushiro is not equivalent in operation to the "gear shift lever" of the present invention.

The 103 Rejection

Courts have held that, in order to justify a rejection under 35 U.S.C. 103, the prior art must (1) have suggested to those of ordinary skill in the art that they should make the claimed device, (2) that the prior art has revealed a reasonable expectation of success to those skilled in the art when so making the claimed device, and (3) both the suggestion and the reasonable expectation of success are founded in the prior art and not in the applicant's disclosure. In re Vaeck, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

In the present case, the Diekhans reference teaches a combine harvester that has an "evaluating and control device" (6), such as a microprocessor, which is connected to receive input from sensors that measure torque values from a main drive and from several power train outputs. The Ushiro reference teaches a tractor having mechanical engine control wherein an accelerator lever (21) operates on a speed governor (17) via a

mechanical release wire (20) and an auxiliary change speed lever (25) operates on the same speed governor (17) but via mechanical release wire (28). There are only two reasonably foreseeable ways to combine these references, and neither one of them would teach the full subject matter recited in claim 1.

Specifically, the Diekhans reference teaches an electronic control circuit for a combine harvester and the Ushiro reference teaches a mechanical control circuit for a tractor. One reasonably foreseeable combination of these two references would be a combine harvester having both the electronic control circuit of Diekhans and the mechanical control circuit taught by Ushiro. In such a theoretical control system, there would be no input from the throttle control switch and from the speed modification switch into the microprocessor of the Diekhans circuit because these switches would be operating the speed governor of the engine directly through mechanical wires. Therefore, the combination of the Diekhans reference and the Ushiro reference would fail to disclose an "engine control circuit" that comprises "a programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch" as recited in claim 1.

Another reasonably foreseeable combination of these two references would be to replace the electronic control circuit taught by Diekhans with the mechanical control circuit taught by Ushiro, but such a combination would completely lack a "programmable microprocessor" as recited in claim 1.

Furthermore, any of the above reasonably foreseeable combinations of the Diekhans reference with the Ushiro reference would additionally fail to teach, or even

suggest, a "gear select lever" constructed to operate as recited in claim 1, or the functional relationships between the "gear select lever," the "speed modification switch," the "gear ratio," and the "throttle control switch" as also recited in claim 1.

Furthermore, neither reference teaches, or even suggests, the "means for storing" that stores "work speed values" and "at least one road speed value" as recited in claim 3. It is clear from the present specification that "work speed values" and a "road speed value" correspond to engine speeds under different conditions. Specifically, "work speed values" are utilized to determine engine speed when the combine harvester is operating to work or harvest a field and "road speed values" are utilized to determine engine speed when the combine harvester is traveling on a roadway or moving from one field to another (i.e., not engaged in harvesting a field), (see instant specification, page 7, lines 4-14). The Diekhans reference teaches only the use of measured output torque values and comparison of these values to maximum torque values. The Ushiro reference does not even contemplate data tables stored for use by a microprocessor. Consequently, neither the Diekhans reference, nor the Ushiro reference, teaches "work speed values" and a "road speed value" as recited in claims 3 and 7.

Conclusion

Applicant has shown that the Diekhans reference fails to teach an "engine control circuit" that comprises a "programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch" as recited in claim 1. The Ushiro et al. reference fails to teach, or even suggest, a programmable microprocessor. Therefore, the combination of the Diekhans reference and the Ushiro et al. reference fail to

teach a combine harvester having an "engine control circuit" comprising a "programmable microprocessor connected to receive input from the throttle control switch and the speed modification switch" as recited in claim 1. The combination of the Diekhans reference and the Ushiro reference would additionally fail to teach, or even suggest, a "gear select lever" constructed to operate in accordance with the present invention, and the functional relationships between the "gear select lever," the "speed modification switch," the "gear ratio," and the "throttle control switch" as also recited in claim 1. Specifically, the proposed combination of the prior art does not teach, or even suggest, "a speed modification switch having a first state and a second state, wherein movement of the gear select lever from a first position to a second position switches the speed modification switch from the first state to the second state and changes the gear ratio" so that the engine runs "at a first speed for a given position of said throttle control when said speed modification switch is in said first state and to run at a second speed higher than said first speed when said throttle control is in said given position and said speed modification switch is in said second state" as recited in claim 1.

For this and all of the above reasons, claims 1 and 3-6 are in condition for allowance and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below signed attorney for the Applicant.

Respectfully submitted,
GRIFFIN & SZIPL, PC

Joerg-Uwe Szipl
Reg. No. 31,799

GRIFFIN & SZIPL, PC
Suite PH-1
2300 Ninth Street, South
Arlington, VA 22204
Telephone: (703) 979-5700
Facsimile: (703) 979-7429
Customer No.: 24203